



Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT

8291/11

Paper 1 Principles of Environmental Management

May/June 2023

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **21** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.

2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.

3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).

4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require *n* responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards *n*.
- Incorrect responses should not be awarded credit but will still count towards *n*.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first *n* responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Question	Answer	Marks
1(a)(i)	precipitation: E; infiltration: D;	2
1(a)(ii)	Return water from lithosphere / soil to atmosphere / air;; <i>Or any two from:</i> (movement of water) to the atmosphere / air; (through) plants / trees;	2
1(b)	<i>any three from:</i> climate change / (enhanced) greenhouse effect / global warming; natural disasters / droughts / flooding; pollution events; inadequate sanitation / lack of money for filtration systems / water-borne diseases; population growth / urbanisation / change in land use; extraction rate exceeding rate of recharge of water sources / overextraction; inefficient irrigation strategies; competing demands for water / wars or conflict; international competition for water; inequality of availability between water-rich and water-poor countries; different access to water in rural and urban areas; poor communities cannot afford water;	3

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Question	Answer	Marks
1(c)	<p><i>any four from:</i></p> <p><i>max 3 from benefits:</i></p> <p>allows a coordinated approach;</p> <p>financial support e.g. HICs / richer countries can support LICs / poorer countries;</p> <p>water is a shared resource which can cross international boundaries;</p> <p>research can be <u>shared</u> (AW) between the countries involved;</p> <p>international organisations have more influence on national governments;</p> <p>promotes education;</p> <p>raises (global) awareness;</p> <p><i>max 3 from limitations:</i></p> <p>governments have to agree to participate;</p> <p>some countries cannot afford to participate</p> <p>infrastructure development may be too expensive;</p> <p>strategies may not be applicable to all countries;</p>	4
1(d)(i)	<p>$(605.7 - 470.6) / 470.6 \times 100;$</p> <p>(+) 28.7;</p>	2

Question	Answer	Marks
1(d)(ii)	<p><i>any four from:</i></p> <ul style="list-style-type: none">improved irrigation techniques;growing crops less dependent on high water supply; reduction in domestic water usage;recycling water;increased use of grey water;rain water capture / collect more rainwater; education on sustainable water use; introduction of meters / tariffs; reduction in industrial use;increased use of desalination; more efficient use of infrastructure / (leaking) pipes repaired; legislation;	4

Question	Answer	Marks
2(a)	<p><i>any three from:</i></p> <p>implement protection / guide actions to conserve endangered species;</p> <p>education / raise awareness;</p> <p>inventory to classify / keep track of species;</p> <p>inform decision makers / influence policy makers;</p> <p>make available information about endangered species and risk of <u>extinction</u>;</p> <p>support scientific research;</p>	3

Question	Answer	Marks
2(b)	<p><i>any four from:</i></p> <p>increase in (global) temperature / (enhanced) greenhouse effect / global warming;</p> <p>sea temperatures increase / sea temperatures not optimum;</p> <p>(increased atmospheric) carbon dioxide dissolves in sea water; pH decreases / sea water becomes more acidic;</p> <p>increased frequency, tropical cyclones / hurricanes; (wave action) damages corals;</p> <p>reduces rate of growth as coral cannot keep pace with sea level rise;</p> <p>causes coral bleaching;</p> <p>sediment run-off covering coral;</p> <p>changing distribution of predator species / invasive species migrate; predate corals;</p> <p>changing availability of food source / nutrients;</p> <p>algal / plankton populations change / algal bloom;</p>	4

Question	Answer	Marks
2(c)(i)	<p><i>any four from:</i> <i>max 3 from positive:</i> does not require expensive technology / inexpensive / local materials can be used; does not require technical skills /easy to install;</p> <p>only small pieces of (parent) coral required; area can still be used for leisure / education; doesn't require large area for nursery lines; corals spread to a much greater area; increase in coral population;</p> <p><i>max 3 from negative:</i> small scale; slow growing / takes long time; labour intensive; intricate / may need to be done in a particular way to be successful; nursery line is made of synthetic material / could be consumed by other animals / other animals might become entangled; reduces gene pool / reduces genetic variation; corals are sensitive to changed conditions in new areas; does not address the cause of the reduction in coral;</p>	4

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Question	Answer	Marks
2(c)(ii)	<p><i>any three from:</i></p> <p>ban harvesting of coral;</p> <p>limit human activity in sensitive areas e.g. tourism, fishing, boating;</p> <p>extractive reserves;</p> <p>national parks;</p> <p>conservation zones / protected areas;</p> <p>reduce waste / pollution in oceans;</p> <p><i>strategies to reduce / limit climate change:</i></p> <p>reduce reliance on fossil fuels / reduce greenhouse gas emissions;</p> <p>increase use of renewable energy sources;</p> <p>develop carbon neutral fuels / develop alternative energy technologies;</p> <p>increase energy efficiency;</p> <p>educate people about energy savings;</p>	3

Question	Answer	Marks
3(a)(i)	<p>line A represents death rate;</p> <p>(at start) line A is lower than line B so population is increasing;</p> <p>(after intersect) line A is above line B so population is decreasing;</p>	2
3(a)(ii)	<p>Migration / immigration / emigration / movement of people;</p> <p>conflict / famine / better economic opportunities / persecution / political asylum / natural disasters;</p>	2

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Question	Answer	Marks
3(b)	<p>young population reaches working age;</p> <p><u>increase</u> in mortality of older / younger population;</p> <p>immigration of working age people; emigration of older people (for retirement);</p> <p>lower birth rate / fertility rate reduces number of younger population;</p> <p>anti-natal policy;</p>	3
3(c)	<p><i>any four from:</i></p> <p><i>max 3 from benefits:</i></p> <p>reduces unwanted pregnancies;</p> <p>allows couples to plan families; allows women to work / stay in education;</p> <p>promotes safe sex / reduces spread of STIs / STDs / HIV / named sexually transmitted disease (use of barrier method of contraception);</p> <p><i>max 3 from limitations:</i></p> <p>may challenge (religious) beliefs;</p> <p>may not be socially / culturally / gender acceptable in some communities;</p> <p>encourages more casual sex;</p> <p>availability of contraception would need to be alongside education/family planning to be successful;</p> <p>lack of access / distribution issues in remote areas;</p>	4

Question	Answer	Marks
4(a)(i)	<p>(when all people, at all times), do not have access to sufficient / enough food / food not affordable;</p> <p>not having access to nutritious food;</p> <p>(that meets their dietary needs and food preferences) for an active and healthy life / meets basic needs;</p>	2
4(a)(ii)	<p><i>any four causes from:</i></p> <p>population growth / overpopulation; shortage of food;</p> <p>increase in homogeneity in global food supply / decrease range of foods grown / increase in monoculture; price setting by government / corporations;</p> <p>land degradation / soil erosion / reduced crop productivity; pests / disease leads to crop failure;</p> <p>diverting crops for biofuels / growing cash crops rather than food;</p> <p>climate change leads to water shortage e.g. drought, wildfires; flooding / natural disasters;</p> <p>poverty (individuals / communities) / unable to afford food;</p> <p>conflict / war leading to distribution issues; transport issues due to poor infrastructure / in remote areas; poor storage e.g. grain after harvest;</p> <p>overfishing; politically disputed fishing grounds; water pollution;</p>	4

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Question	Answer	Marks
4(b)	<p><i>any six from:</i></p> <p><i>max 4 from benefits:</i></p> <p>allows crops to be grown all year;</p> <p>requires less space / increases production per unit area / high yield;</p> <p>produces high value crops;</p> <p>uses a low amount of water / recycles water;</p> <p>allows controlled use of fertilisers;</p> <p>low requirement for pesticides / uses less pesticides;</p> <p>protected from pests / diseases as in controlled environment;</p> <p>limits potential water pollution;</p> <p>can be automated / low labour costs;</p> <p>can be grown indoors / not weather dependent;</p> <p>no soil needed;</p> <p>allows production in urban areas;</p> <p><i>max 4 from limitations:</i></p> <p>high investment required / cost of set-up high;</p> <p>requires skilled labour;</p> <p>reliant on technology / monitoring;</p> <p>uses electricity which is costly;</p> <p>only suitable for some crops;</p>	6

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Question	Answer	Marks
4(c)	<p><i>any four from:</i></p> <p>improve crop yield / productivity;</p> <p>allows cultivation of wider variety of crops;</p> <p>pesticides kill / protect crops from fungi / weeds / insects / rodents;</p> <p>fungal infections limit photosynthesis / can cause leaves to fall off / cause defoliation / cause the crop to decay / make crop inedible / prevent sale of the crop;</p> <p>reduce competition of the crop with weeds;</p> <p>reduce damage to standing / field crops;</p> <p>reduce damage / reduction of <u>stored</u> crops;</p>	4
4(d)	<p><i>any two from:</i></p> <p>require less input from farmers / work is less seasonal for farmers / lower demand on machinery;</p> <p>cost efficient / less seed / less seedlings;</p> <p>capture water / slows water through water cycle / help prevent flooding;</p> <p>protect soil from erosion;</p> <p>capture carbon / carbon store / reduce atmospheric carbon dioxide / limit climate change;</p> <p>could retain biodiversity / habitat;</p>	2

Question	Answer	Marks
5	<p>‘Using waste to generate electricity is an effective strategy for reducing the impact of waste disposal.’</p> <p>To what extent do you agree with this statement?</p> <p>Give reasons and include information from relevant examples to support your answer.</p> <p>The question requirements are to:</p> <ul style="list-style-type: none"> • show an understanding of waste disposal methods • describe the impacts of waste disposal methods • describe how waste generates electricity • evaluate the statement with particular emphasis on reducing the impact of waste disposal <p>This question assesses AO2 and AO3 skills.</p> <p>Indicative content</p> <p>Candidates may refer to methods of waste disposal, such as landfill, incineration, storage, disposal at sea, recycling and exporting waste. The methods may refer to individual, local and national waste disposal methods.</p> <p>Candidates may describe local and global impacts of waste disposal, such as contamination of soil and ground water, leaching of toxic substances, heavy metals, bioaccumulation, biomagnification, release of greenhouse gases, plastics and microplastics.</p> <p>Candidates may suggest that other methods are more effective, such as reduce, reuse, recycle, biodegradable plastics, food waste for animal feed, composting, fermentation, education, financial incentives and legislation.</p> <p>Candidates should describe how waste is used to generate electricity and describe the impacts, such as release of greenhouse gases, particulates, toxic chemicals and the production of large volumes of ash.</p> <p>Candidates need to focus on the balance of impacts when evaluating the statement.</p> <p>Candidates are likely to agree that using waste to generate electricity is a suitable strategy but answer should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.</p>	20

Question	Answer		Marks
5	General levels of response		
	Level	AO2: Information handling and analysis	Marks
	3	<ul style="list-style-type: none"> • Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic. • Incorporates frequent use of directly relevant examples. 	7–8
	2	<ul style="list-style-type: none"> • Responses contain explanations with some gaps or errors in the reasoning. • Explanations may lack detail or accurate knowledge. • Examples are included but some opportunities to include relevant examples are missed. 	4–6
	1	<ul style="list-style-type: none"> • Responses contain a few general points, which are mainly descriptive, comprising a few simple points, • Knowledge is basic and understanding may be poor and lack relevance to the question set. • Irrelevant or no examples are given. 	1–3
	0	<ul style="list-style-type: none"> • No creditable response. 	0

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Question	Answer			Marks
5	Level	AO3: Investigation skills and making judgements	Marks	
	4	<ul style="list-style-type: none"> • Clearly presents and develops both sides of the argument. • Judgements are fully supported with relevant qualitative and / or quantitative information • Clear balanced conclusion which is consistent with the question and candidate response. 	10–12	
	3	<ul style="list-style-type: none"> • One side of the argument is better developed than the other. • Judgements are partially supported with qualitative and / or quantitative information • Conclusion is consistent with the question and candidate response. 	7–9	
	2	<ul style="list-style-type: none"> • Describes only one side of the argument. • Judgements have minimal support; qualitative or quantitative information lacks relevance. • Conclusion may be inconsistent with the question and candidate response. 	4–6	
	1	<ul style="list-style-type: none"> • Response is descriptive. • Minimal judgement is made, unsupported by qualitative or quantitative information, • Conclusion is inconsistent with the question and candidate response, or no conclusion made, 	1–3	
	0	<ul style="list-style-type: none"> • No creditable response 	0	

Question	Answer	Marks
6	<p data-bbox="338 217 1637 248">Evaluate the success of strategies for managing the impacts of human activity on Antarctica.</p> <p data-bbox="338 288 1541 320">Give reasons and include information from relevant examples to support your answer.</p> <p data-bbox="338 360 779 392">The question requirements are to:</p> <ul data-bbox="338 392 1845 528" style="list-style-type: none"> • show an understanding of the direct and indirect impacts of human activity on Antarctica (the phrases direct and indirect impacts are not required) • describe successful and less successful strategies • evaluate the success of both direct and indirect impacts <p data-bbox="338 568 595 600">Indicative content</p> <p data-bbox="338 632 1928 695">Candidates should describe direct impacts on Antarctica, such as scientific research, tourism, waste disposal, disturbance of protected species, overfishing, whale hunting, introduction of non-native species, future mineral and oil extraction.</p> <p data-bbox="338 735 1693 767">Candidates should describe indirect impacts on Antarctica, such as climate change and ozone depletion.</p> <p data-bbox="338 807 1883 903">Candidates should show an understanding of strategies for managing the impacts, such as legislation and international agreement (the Antarctic Treaty 1959), protected areas, fisheries regulation, prohibited activities such as mineral extraction, protection from non-native animals or plants, waste management, tourism control and permits for travel.</p> <p data-bbox="338 943 1906 1007">Candidates may use specific examples of individual, local, national and international strategies. The examples should be balanced and show successful and less successful programmes.</p> <p data-bbox="338 1046 1883 1110">Candidates are likely to be split over their conclusion but answer should be balanced. Answers should be supported by case studies / relevant examples where this provides balanced evidence.</p>	20

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Question	Answer		Marks
6	General levels of response		
	Level	AO2: Information handling and analysis	Marks
	3	<ul style="list-style-type: none"> • Responses contain reasoned explanations with knowledge that indicates a strong conceptual understanding of the topic. • Incorporates frequent use of directly relevant examples. 	7–8
	2	<ul style="list-style-type: none"> • Responses contain explanations with some gaps or errors in the reasoning. • Explanations may lack detail or accurate knowledge. • Examples are included but some opportunities to include relevant examples are missed. 	4–6
	1	<ul style="list-style-type: none"> • Responses contain a few general points, which are mainly descriptive, comprising a few simple points, • Knowledge is basic and understanding may be poor and lack relevance to the question set. • Irrelevant or no examples are given. 	1–3
	0	<ul style="list-style-type: none"> • No creditable response. 	0

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Question	Answer			Marks
6	Level	AO3: Investigation skills and making judgements	Marks	
	4	<ul style="list-style-type: none"> • Clearly presents and develops both sides of the argument. • Judgements are fully supported with relevant qualitative and / or quantitative information • Clear balanced conclusion which is consistent with the question and candidate response. 	10–12	
	3	<ul style="list-style-type: none"> • One side of the argument is better developed than the other. • Judgements are partially supported with qualitative and / or quantitative information • Conclusion is consistent with the question and candidate response. 	7–9	
	2	<ul style="list-style-type: none"> • Describes only one side of the argument. • Judgements have minimal support; qualitative or quantitative information lacks relevance. • Conclusion may be inconsistent with the question and candidate response. 	4–6	
	1	<ul style="list-style-type: none"> • Response is descriptive. • Minimal judgement is made, unsupported by qualitative or quantitative information, • Conclusion is inconsistent with the question and candidate response, or no conclusion made, 	1–3	
	0	<ul style="list-style-type: none"> • No creditable response 	0	